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ABSTRACT

This article describes the development of an undergraduate psychology program in human factors engineering (the application of psychological principles to systems/technology development and usage). The need for such programs, as evidenced by the positive reactions of industry and academia to the program at Kearney State College, Kearney, Nebraska, is noted. Problems requiring consideration during the development and administration of the program are discussed, including: (1) recruiting science-oriented high school students; (2) filling the gap created by the lack of an engineering curriculum; (3) providing students with opportunities for application of skills; and (4) fostering awareness of human factors in agencies that could benefit from it. The employment prospects for undergraduates with degrees in this area are discussed, and it is suggested that human factors programs may provide an avenue to fulfilling careers for those psychology majors who do not expect to continue their education beyond the baccalaureate level. A list of required and elective program courses is provided. (Author/WAS)

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# AN UNDERGRADUATE PROGRAM IN HUMAN FACTORS: THE NEED, THE PROBLEMS, AND THE OUTLOOK

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# An Undergraduate Program in Human Factors: The Need, the Problems, and the Outlook

by

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## ABSTRACT

Undergraduate programs in human factors engineering are a new development within the area of psychology. The need for such programs is evidenced by the overwhelmingly positive reactions of industry and academia to a program developed at Kearney State College. Among the problems requiring consideration during the development and administration of this program were: 1) recruiting science-oriented high school students, 2) filling the gap created by the lack of an engineering curriculum, 3) providing students with opportunities for application of skills, and 4) fostering awareness of human factors in agencies that could benefit from it. Dealing with these problems has revealed that the employment prospects for undergraduates with degrees in this area are bright, and that human factors programs may provide an avenue to fulfilling careers for those psychology majors who do not expect to continue their education beyond the baccalaureate.

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1. The Spring meeting of the Nebraska Psychological Association, Lincoln, NE, April 16, 1983.
2. The 1983 Annual Meeting of the Rocky Mountain Psychological Association, Snowbird, Utah, April 28, 1983

# An Undergraduate Program in Human Factors: The Need, the Problems, and the Outlook

by

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The Department of Psychology at Kearney State College, like so many others without graduate programs, faces the dilemma of placing graduates with a bachelor's degree alone. The job prospects for graduates, even with teaching endorsements, are not rosy.

Nevertheless, there are some very promising opportunities at the baccalaureate level for psychology majors who are skilled not only in psychology, but in certain applied quantitative areas as well. Specifically, prospects are bright in the area of human factors. Human factors is a discipline whose goal is the application of psychological principles to systems/technology development and usage. It is the discipline which came of age following World War II, as a part of industrial psychology. It is also a discipline which receives about a one-paragraph coverage in most general psychology texts.

Kearney State College has a fairly typical undergraduate program, in which students complete a Bachelor of Arts or Bachelor of Science degree by taking courses covering the traditional range from physiological psychology to

developmental psychology to theories of personality. The department deals with many majors who have no desire to continue their education beyond the baccalaureate. Therefore, a major ongoing endeavor within the department is to find ways in which to make our graduates more attractive in the job market. Human Factors was an area which we suspected might provide a unique opportunity for our majors, so we decided to develop a comprehensive program in this discipline.

A number of questions became apparent almost immediately and had to be considered. These included:

1) Human factors is an area that has been traditionally tied to engineering. Kearney State College has no engineering program. Could courses already developed on campus substitute for the engineering coursework found in human factors programs?
2) If the focus of this program is on application, are there sources of support within the industrial and business community who would be willing to offer internship and/or practicum experiences for our majors? and
3) Can a college which has had a focus on teacher education and developed its library holdings largely along these lines, be sufficient to support a program in human factors?

It should be noted that, at this time, there exists no other undergraduate human factors program operated by a psychology department in the United States, although there are a few developed within undergraduate industrial engineering departments. Thus, we were treading on very new territory.

Our first step was to consider the first question cited above. We attempted to draw on our resources in areas that were tied, in some way, to the human factors discipline. In addition to developing a strong experimental psychology emphasis in the program, we included relevant coursework offered by the departments of statistics, mathematics, computer science, industrial education, and safety education. All of the courses included were those that offered students an opportunity to learn and use the tools of human factors research. Our final course list is shown in Table 1. As you can see, the student can specialize to some extent, through electives, in safety, quantitative methods, or the human computer interface. This work was not done by a department functioning within a cocoon. We wanted to know what kind of reactions professional human factors people would have, so we asked them. The response was gratifying, to say the least.

Table 1

Human Factors Program Courses

REQUIRED COURSES

| | | |
|---|---|---|
| PSY | 203 - | General Psychology |
| PSY | 250 - | Research Methods |
| PSY | 270 - | Experimental Psychology |
| PSY | 311 - | Human Learning & Memory with Lab |
| PSY | 312 - | Sensation & Perception with Lab |
| PSY | 371 - | Environmental Psychology |
| PSY | 410 - | Industrial Psychology |
| PSY | 425 - | Human Factors & Safety |
| PSY | 498 - | Instrumentation |
| C.S. | 109 - | FORTRAN Programming |
| C.S. | 375 - | Operations Research |
| STAT | 345 - | Applied Statistics I |
| STAT | 448 - | Regression Analysis |
| MATH | 101B- | College Algebra |
| MATH | 215 - | Calculus I w/Analytic Geometry |

ELECTIVES

| | | |
|---|---|---|
| PSY | 313 - | Physiological Psychology with Lab |
| PSY | 372 - | Cognitive Psychology |
| PSY | 499 - | Research in Psychology |
| S.E. | 435 - | Occupational Safety and Health |
| S.E. | 436 - | Organization, Administration and Supervision of Safety Programs |
| S.E. | 499 - | Individual Research in Safety |
| C.S. | 201 - | Assembler Languages |
| C.S. | 400 - | Computer Simulation |
| C.S. | 410 - | Advanced FORTRAN |
| STAT | 445 - | Applied Statistics II |
| IND ED | 382 - | Applied Electronics |
| IND ED | 483 - | Digital Electronics |

For example, Hugh E. Cahill, a member of the Human Engineering and Maintainability Staff at Lockheed Missiles and Space Company in Sunnyvale, California, said:

> "I have felt for years that a human factors program at the undergraduate level would be feasible, and I commend you for the action that you have taken. Your program looks sound and up-to-date with its opportunities for becoming familiar with computer related skills."

Additionally, Lockheed Missiles has expressed an interest in offering paid research internships to our qualified students, which include transportation to and from California!

Boeing Military Aircraft Company in Wichita, Kansas, is also very interested in working with us in terms of internships, government contract work, etc.

Thus, question one appeared to be answered. The need was there, and the proposed coursework was approved by many experts in the area, including John Kreifeldt of Tufts University, who was extremely helpful in a number of areas too numerous to mention here.

The second question was not difficult to answer, but the results of our inquiries to local businesses and and industry were less than exciting. Kearney is not

a large city, and industrial internships must, necessarily, be limited to fairly large companies or small ones with particular needs. Although a number of local industries, including Rockwell International's Flow Control Division and Caldwell Manufacturing, were interested in the program, several also held a "wait and see" attitude concerning internships. Nevertheless, this did not cause us tremendous concern because the response from outside the Kearney area was so great.

Finally, with regard to this question, it should be noted that several law firms in town expressed considerable interest in our program, once the brochure had been distributed. As a result of this interest, several opportunities now exist for qualified students to do some human factors investigative work under my supervision and internships in this area may be a next step.

With regard to answering the final question, we encountered some difficulties. The library book and journal holdings are not nearly sufficient to support the program, and additional materials are sorely needed. However, Kearney State College <u>is</u> a depository for government documents, and relevant holdings in this particular area are not too bad. It is also possible to acquire some of the government documents that are not usually received by our library. It is our hope to

remedy this situation by the time we have a reasonable number of students in the program.

Since our program has been approved, a few other problems have faced us, the largest being recruiting of students. We were able to generate some degree of interest among our majors, particularly following a symposium given at Kearney State College by Dr. Gavriel Salvendy, a leading human factors engineer from Purdue University. Unfortunately, much of the interest we generated was among students already near completion of their programs. Several now intend to do graduate work in this area.

Two problems relate to the difficulty of recruiting majors:

1) the student already enrolled doesn't hear much about human factors early in his/her program. General psychology courses omit coverage of this area, and many students don't even know it exists, and
2) many of our majors are not, to put it, "cut from the mold from which human factors engineers are made."

We are currently taking steps to solve these problems. With regard to the first, the department is in the processing of choosing a new general psychology text for

next year. Realizing the need for coverage in these applied, non-clinical areas, I am only considering texts with: a) good application and b) a coverage of such content areas as environmental psychology, industrial and organizational psychology, and/or human factors. These texts do exist, and include:

1) John P. Dworetzky's Psychology, West Publishing Company,
2) Benjamin B. Lahey's Psychology: An Introduction, William C. Brown, Publisher, and
3) Ronald E. Smith, Irwin G. Sarason, and Barbara R. Sarason's Psychology: The Frontiers of Behavior, Harper & Row.

The second problem needs elaboration. Many of our psychology majors enter the field with far too many misconceptions. They want to be counselors or clinicians, and have no idea that: 1) graduate school is a must, and 2) even these specialities require a working knowledge of math, science, and statistics, if one is to succeed. They often struggle through requirements like research methods and experimental psychology, filled with math anxiety and a great desire to avoid these types of courses in the future.

Needless to say, given the human factors program course list shown above, this is not the type of student suited for this program. We need students who are comfortable with math, science, statistics, and even computers. Unfortunately, the bulk of these students enter other fields, instead of psychology. Therefore, we are attempting to contact just these students while they're still in high school, to make them aware of human factors. In addition, we are targeting the group of freshmen and sophomore "undecided" students who have aptitudes in these areas, for dissemination of program information. It is hoped that this effort will be successful and allow the human factors program at Kearney State College to grow and flourish.

In conclusion, the point should be made that human factors, as a discipline, needs to be promoted. The Human Factors Society is far too aware of the problem. Although Bell Laboratories, Western Electric, Honeywell Inc., and other large industries and government agencies have made great strides through human factors, the average company doesn't know what human factors is and what it can do for them. Perhaps the program at Kearney State College can foster some of that awareness, at least within our little corner of the world.